TITLE

SUBTERRANEAN DRAIN DEVICE WITH IMPROVED FILTRATION

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a Continuation-in-Part of U.S. patent application S/N 10 / 318, 644, filed on 12/16/2002 by the same inventor, entitled: Subterranean Drainage Device (in issue), which was a Continuation-in-Part of U.S. patent application S/N 10 / 292,298, filed on 11/12/2002 by the same inventor, entitled: Drainage and Footing Form Device, both for which priority under 35 USC 119(e) and 120 is hereby claimed.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to devices and constructs used to effect subterranean drainage from building entrenchments, such as footings, foundations and walls, where seepage and ground water are a problem, and also under garage and basement floors where overburden of concrete exacerbates the drainage problem by frustrating most existing devices or their filtering adjuncts. More specifically, this invention embodies a filtration improvement to known planar or "sandwich" devices that are relatively rigid apparata, with respect to their installation, yet can be rolled up in one or two directions,

as well as in two alternate directions, while having filter fabric permanently adhered to at least one of the planar surfaces.

2. Discussion of Relevant Art

It has long been a practice, in the construction industry, to provide some form of drainage in subterranean structures. Ground water seepage is an incessant problem in most non-arid regions of the world and building footings, garage floors (multi-level) and walls facing surface and sub-surface waters have been most susceptible to water incursions. Many drainage devices have been provided, as well as adjuncts thereto, in order to provide adequate carry-off of these undesired waters; some of the adjuncts provide a modicum of filtration of the minute particulate that is so common in most soils. In many cases, the filtering mechanisms must employ more than one medium of sifting-filtering material because of the varied aggregate and soil or sand mix in which the construction takes place. Over the years, the industry has progressed from sealing walls and such with tar and providing graded stone barriers between structure and earth, to the use of prefabricated drain devices combined with overlays of unique geo-textiles that filter out fine particulate, do not environmentally degrade and obviate, to some degree, the need for vast amounts of stone interposed the structure and earth.

Although for the most part such draining, with concomitant filtration, is performed using tiles, stone and paper/fabric overlay (such as in drywell and septic usages), conscientious builders have transitioned to more effective and reliable forming, draining and filtering modalities. The instant improvement, in fact, provides all three modalities in a single device that can be used both adjacent and beneath concrete structures.

Two patents are germane to discussion of the present invention: U.S. Patents Nos. 5,466,092, issued November 14, 1995, entitled: FORM-DRAIN FILTER and 5,634,741, issued June 3, 1997, entitled: FORM-DRAIN FILTER CLAMP. To my knowledge, this was the first combination of a concrete form, that was communicative (through multiple foramens) with ground waters and was provided a filter adjunct comprised of geo-textile fabric. The former reference established the principle that a filter fabric might be secured to the surface of the form-drain by some adhesion means, while the latter provided physical mechanisms (various clamps) that effected the same attachment. Further, the latter shows a dual-channeled drain. The main limitations in this art follow from the single purpose nature of the drain device -- it is a concrete form, and no more. Also, fixing the fabric to the discrete units of the drain may present set-up cutting problems, in the field. Thus, these devices do not reflect the broad range of usefulness acquired by the sub-surface drainage devices, with filter, shown in the instant disclosure and its cross-referenced applications.

Unfortunately, with the use of a smaller and multi-channel, more flexible and sophisticated drainage device capable of far-ranging usage, comes the likelihood of filtering problems that require a more elegant structure, especially if the filtering element is to be provided during manufacture. That a filter is desirable, given the nature of very small aperture drain mechanisms, is rationalized by the observation that even water can be impeded, in its passage through the apertures, if the fabric is pressed into the perforations by concrete or soil overburden.

As indicative of the art that pre-existed before the above patent, U.S. Patent No. 3,888,087, for FOUNDATION WALL PROTECTIVE SHEET ('087), offers one of the

first devices for providing dimples (posts or detents), as a stand-off mechanism for spacing a filter fabric from the single plane base of the device, and a physical folding crease to accommodate bending about a foundation. This apparatus is quite flexible, but using only a filter fabric as a second ply, it lacks the overburden capability for which I designed my planar devices. Further, and of significant detriment, is the requirement that the filtering medium be applied *in situ*, when the devices are installed.

INCORPORATION BY REFERENCE

Because they show both the present state of the art in drainage devices having an internal channeled structure, as well as disclosing filtering adjuncts or various standoff mechanisms, U.S. patents, numbers 5,466,092, 5,634,741 and 3,888,087, with the aforesaid priority applications, are hereby incorporated by reference.

DEFINITIONS

Generally throughout this disclosure, words of description and claim shall have meanings given by standard English usage; however, certain words will be used that may have a more stylistic meaning and are defined as follows:

construct - herein, generally, an article or a building structure;

continual - having intermittent, or periodic, breaks or discontinuities;

continuous - having no breaks or discontinuities;

integral - necessary to complete or in itself complete;

nodule - a projection of indefinite shape that can be sinuous, elongate or be, simply, a detent or post;

off-set - a term describing the state of **slices**, or slice patterns, that are parallel to others of the *genre*, but not overlapping nor superposed--as opposed to "alternating", which compels an *ordered off-setting* of patterns;

partition - an projection separating two planar sheets, incipiently continuous but rendered continual by various **slices,** according to the instant teaching;

permeable - anything, having a character that allows a substance, such as a fluid, to pass through it;

posts - as used herein, projected elements, also dimples (in prior art) or detents;

rigidity - a physical property of an object wherein the object substantially resists deflection in a particular dimension (direction) or plane;

sandwich - the configuration made by placing one planar surface over, but set apart from, another;

slice - a through-cut in the surface(s) of the invention that passes through an intervening **partition**, but does not penetrate the opposite surface or plane;

stand-off - a spacing element or device;

tent - a sub-structure of the instant invention that consists of a fixed draping of the filter fabric over or about a drain device surface aperture from which the fabric, as well as particulates, must be excluded;

tubule - a support element of the filter structure that defines, generically, any and all support projections having tube-like morphology, whether hollow; and,

unitary - having wholeness, as in a single unit or monolith composed of plural members.

The above listing is not exhaustive. Certain other stylized terms, used previously or hereafter, are defined at the time of their first usage or placed in quotation marks and used with conventional wording.

BRIEF SUMMARY OF THE INVENTION

The deficiencies or limitations of the earlier art are overcome by providing an inexpensive, easily applied innovation allowing continued rollup capability to a state-of-the art drain device that bears a fixed filter fabric over at least one surface.

The preferred embodiment of the invention is worked on a pre-existing drainage device that consists in a generally water-impervious, semi-rigid plastic "sandwich", having top and bottom planar members separated by a series of parallel partitions or a post matrix; either forming an integral and monolithic unit with the planar members. Foramens are provided on the surface that is interposed the device and a water source, such as ground or under-the-floor seepage. Whether the partition, or post, interstitial paradigm is employed, remains a manufacturer's and consumer's choice. In either structure, channels are formed for the communication of waters through a surface of the sandwich and into a drainage network. The sandwich device is, in itself, capable of withstanding considerable overburden without collapsing. The instant invention modifies the sandwich device by placing in it a series of linear slices ("cuts") that imbue the sandwich with the desired high degree of flexibility, while retaining essentially all of its structural strength.

To prevent soil or concrete overburden from pressing filter fabric into the apertures or foramens of the drain device, multiple short projections known as dimple, detent,

partition, post or nodule networks/arrays are employed as stand-off mechanisms. These stand-offs provide supports, the tops of which are overlain by, and fixed to, the geo-textile filter fabric.

The stated goal being achieved, there is acquired not only a device that has unlimited in-ground use, with high overburden sustainability, but one retaining a high degree of flexibility that allows compact rolling, for ease in handling, storage and shipment.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Of the Drawings:

FIG. 1 is a prior art illustration of a subterranean drainage article that is improved by the instant invention;

FIG. 2 is a plan view of the FIG. 1 device conformed to the improvements of the invention;

FIG. 3 is an elevation of the invention, taken at **3-3** of FIG. 2;

FIG. 4 is a plan view of the FIG. 2 device conformed to the improvements of the alternate embodiment of the invention;

FIG. 5 is an elevation of the alternate embodiment of the invention, taken at **5-5** of FIG. 4;

FIG. 6 is an elevation of the alternate embodiment of the invention, taken at **6-6** of FIG. 4;

FIG. 7 is an isometric illustration of the invention featuring post-type projections;

FIG. 8 is a plan view of the invention featuring cross-pattern slices of the alternate embodiment;

FIG. 9 is a drawing of an article of the invention, as derived from FIG. 1;

FIG. 10 is a copy of FIG. 5 showing the filter adjunct in cross-section;

FIG. 11 is a copy of FIG. 6 showing the filter adjunct in cross-section; and

FIG. 12 is a detail, taken at **12** of FIG. 11.

DETAILED DESCRIPTION OF THE INVENTION

The drainage device of the prior art, shown in FIG. 1, is employed in construction situations where there is required an unusual strength to sustain heavy earth, gravel or concrete overburdens, such as those encountered in basements, parking garages and earthworks. It is packaged as stacked elements and, because of its monolithic structure, resists the tendency to roll or curl that attends a segmented or discontinuous structure. For the most part, there is shown here a first example or exhibit EX1 of the device, and a second, EX2, joined by an adjunct, a hollow coupling rod or spline R, devised by the instant inventor to aid in the alignment of the apparatus. In the prior art, the device is either affixed to a wall or lain on a prepared earthwork. Perforations or holes H are provided so that seepage will readily enter the otherwise liquid-impermeable top plane. For the sake of clarity, such hole H illustrations will be generally omitted from subsequent drawings, with but a nominal few being shown in FIGS. 4, 7 and 8. Final to installation, a filter fabric F is overlain the device(s), to exclude soil particulate or liquid suspensions that could foul the drain channels D; filtration is improved, hereinafter.

Referring to FIG. 2, there is shown a partial cut-away plan view of the preferred embodiment of the invention 10. The monolithic, non-biodegradable and, preferably, polymeric plastic structure consists integrally in a top plane 12, a bottom plane 14 and an

interstitial parallel partition 16 structure. That the separating partitions are perpendicular to the separated planes 12,14, as shown in the post-separated model of FIGS. 7 and 8, is not a hard and fast rule of the instant inventor. Because the article of this invention is most easily acquired by the process of extrusion, almost any strength-lending interstitial structure may be realized; for example, **X**-shaped supports (not shown) would do just as well in providing weight-bearing strength and shape retention. The only attribute required, besides the foregoing, is that water passages or drain channels D be provided.

Continuing in FIG. 2, slices 18 are shown in the top plane; such top plane slices are continued through any intervening supports and are termed, simply, support slices 20. It must be noted here that the support slices 20 are confined only to the support mechanisms 16 and do not enter the bottom plane 14. Referring to the cut-away portion of FIG. 2, there can be seen a single instance of a bottom plane slice 19, in off-set relationship with any top plane slice 18. Like the slicing technique used in the top plane, bottom plane14 slices 19, cut through any intervening support 16, but not the top plane 12. FIG. 3, taken at **3-3** of FIG. 2, exemplifies this feature of the invention. Referring specifically to FIG. 3, this elevation view, looking into the partition structure, shows the top plane 12 slices 18 penetrating the intervening partition 16 as partition slices 20; but, the slices do not penetrate the opposite plane 14. The off-set character of the slices in a plane surface cutting through only intervening supports, but not the opposite plane, forms the *nexus* of the invention. It is this unique technique that allows the invention to be rolled into two dimensions, above or below the plane shown in FIGS. 1, 3, and 5-7. It is stressed that the instant inventor teaches an off-set slicing technique, rather than an "alternating" one. In this invention, the manufacturer has, for any reason, the option of employing any slice

pattern in an ordered or non-ordered manner, depending on the desired degree of flexibility (and thus, roll ability).

In a cut-away plan view, FIG. 4 depicts an alternate embodiment of the invention 10 having another off-set slice pattern, similar to that of FIGS. 2 and 3, but in an orthogonal or cross-hatch array. This embodiment features the second array composed of parallel top slices 22 and bottom slices 23; here, the slices 22,23 are off-set from each other and situated, at closest proximity, between adjacent partitions. Holes H are show in nominal quantity, in communication with the channels D. It should be understood that such perforations may take on a host of shapes or sizes, often chosen by a consumer, depending on whether it intends to use fabric or aggregate interposed the device and a seepage source.

FIGS. 5 and 6, taken respectively at **5-5** and **6-6** of FIG. 4, are analogous to FIG. 3, showing, in two views, that the second slice pattern differs little from the first, but now lends further bi-directional roll ability in the second, orthogonal dimension of this "sandwich" plane. Again, the hole(s) H shown is(are) nominal, and represent plural such apertures in the design.

The isometric illustration of FIG. 7, along with its correlative plan view, FIG. 8, show, essentially, the invention 10 previously described, but in an alternate embodiment 11. Here, the invention takes on the basic aspects of the instant inventor's earlier work: a bottom sheet 14 of non-biodegradable, plastic type of material (ABS, PVC, CPVC, polypropylene or similar); truncated post-type projections 17, from and integrally joined to the base sheet; and a top, planar structure 12 secured to the tops of the posts 17. The top structure effected here (and in his earlier work) is a plurality of strips, but it is most

accurately defined as a continuous planar sheet that is rendered discontinuous by one or more slices 18, as shown. All other previously disclosed incidents of the invention are present, including: holes H in one surface (of the plane/sheet); off-set top and bottom slices 18,19, running in one direction; a second set of similarly off-set top and bottom slices 22,23, running essentially 90° to slices 18,19; drains/channels D; solid or hollow coupling rod R; and, as seen in FIG. 7, filter fabric F.

Earlier, it was discussed that the invention readily lent itself to an extrusion construction process. However, this is not a limiting factor in its physical realization. As shown in FIGS. 7 and 8, bottom plane 14 projects cylindrical posts 17, which portray, in the abstract, any variety of frusto-geometrical constructs, such as rectilinear, trapezoidal or cylindrical detents, dimples or projections. **[NOTE:** As shall be seen hereinafter, networks of similar projections are useful on the surface of one or both of the planar surfaces for attaching the aforementioned filter fabric so as to maintain it in set apart relationship with the surface, particularly away from, but yet proximate, any slice, hole or similar aperture in that surface, and thus, obtain improved filter characteristics.] Such constructs are formed by extrusion, molding, machining and/or rolling mill techniques. Subsequently, the top plane(s) 12 is(are) affixed to the lower plane-support ensemble and final machining takes place to achieve the character of this instant invention. Since the field is well informed of the manufacturing techniques employed to make this invention, further comments of this nature are now deferred. After the top plane 12 is provided, machining is performed, as necessary, to acquire the cuts or slices 18, 19 and holes H.

Addressing now the improved filtration aspects (*ibid.*, above **NOTE**), FIGS. 9 through 12 define multiple projection features that are provided as filter fabric supports,

but which are permanently fixed to the fabric during the manufacturing process. Because the slices 18, 19, 22, 23 and holes H are vulnerable to fabric impaction, when the invention is employed as a concrete form, or must sustain a heavy overburden, a stand-off mechanism for the fabric and secured fabric proves invaluable. Adhering the fabric cannot be reasonably done on the job because such an activity is time consuming and requires coating application skills not readily available during the footing installation and subterranean phases of construction.

Referring to FIG. 9, there is shown a subterranean drainage/form device EX1 of the familiar sandwich construction consisting, minimally of a top plane 12 over a bottom plane 14, both planes spaced apart but integrally joined by a plurality of partitions 16. Upgrading this device to the drain of the instant invention is done by the previously mentioned machining/milling techniques; here, such provide slices 18 and holes H. The crux of this improvement, relating to filtration, lies in the technique of providing , on one or two of the planar surfaces, an array of stand-offs or projections that serve as props for the filter fabric F tenting (not shown). The clear distinction of fabric usage, herein, is the adhesion of the fabric to tops of all, or a preponderance of all, the projections. Further, the projections are of varied forms, construction and adaptation: the forms including tubules 100, arced/sinuous tubules 102, dimples/detents 104, split platforms (button) 106, and ribs/vanes 108; the construction being integral (with initial extrusion or molding), milling, and high viscosity lay down; and, adaptation of the projections to the fabric by pre-formation (as integral construction) and adhesion or concurrent projection formation (say, by extrusion of adhesive) and overlay of fabric with adhesion, just prior to completion of adhesive curing. Most of these methods are in current use in a number of

industries such as that which produces cellular window treatments, vehicle body repair, and even dentistry. It is not the purpose of this disclosure to discuss the many manufacturing techniques available for realizing the invention; hereafter only the resultant articles are related.

FIGS. 10 and 11 show the filtration improvements adapted to the articles of FIGS. 5 and 6, respectfully. In these figures, it should be understood that the type of projections used, as well as types and quantities, remain the manufacturer's prerogative. The straight projections (or nodules), e.g., 100,108, that parallel the drain chambers, are readily extruded with the sandwich production (FIG. 9, EX1). These, as well as the remaining types, 102 - 106, are applied as or with adhesive or by milling/stamping. The advantage of using an adhesive for the creation of the projections is that the fabric can be applied during the curing process. It would seem that the most economical forms consist in detents/dimples 100, tubules 104 and ribs/vanes 108 (see phantom plurality in FIG. 11), in order of expense. The platform/button 106 would be practical if the planes 12, 14 were molded separately. The filter fabric is shown as a wrap in FIG. 10 and "laminated" in FIG. 11, yet again a manufacturer's choice for acquiring the extensive tent feature of the invention.

Finally, the detail **12,** of FIG.11, is presented in FIG. 12 to illustrate that during the adhesive lay down phase, it may be useful, and therefore preferable, to employ a lamination or contact of the fabric F directly to certain non-aperture portions of the drain device (see 110 in leftmost portion). Transverse strips along the full length and width of the device would facilitate cutting the sandwich during installation and could also be used to provide slack in the fabric covering, to aid in rolling the finished drain.